



FourthRack[®] G.704 Line Card

User Guide

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Communications answers for the World Market

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1 Introduction

The Fourthtrack Systems FourthRack G.704 Line Card is a derivative of the highly successful MicroMux G.704. The FourthRack G.704 Line Card has been engineered to reduce cost and increase functionality in this expanding sector of the market, and thus enhance Fourthtrack's position as the market leading provider of G.703 / G.704 Data Service Units (DSUs).

It is designed to enable the connection of data communication systems to carrier services, or private services, such as microwave links, that are presented as G.703 / G.704 at 2.048Mbps. The standard model supports an X.21 DTE with 75-ohm un-balanced G.703 termination. The enhanced version can support both X.21 and V.35 DTE with 75-ohm un-balanced termination. Both versions are also available with 120-ohm balanced termination of the G.703 network connection.

The FourthRack G.704 Line Card is designed to be used in the FourthRack Chassis. The FourthRack chassis is a next generation rack-mount system that supersedes the MegaChassis, with the FourthRack G.704 superseding the MicroMux G.704 RM line card. The FourthRack Chassis has fourteen line card slots and two power supply slots, one at each end of the chassis. The FourthRack Chassis can be used with either a single power supply or dual power supplies for resilience. Auto-ranging, self sensing AC power supplies, and DC power supplies (-48VDC), are available. Please refer to the FourthRack Chassis documentation for further information.

2 Installation

On unpacking the FourthRack G.704 Line Card you should find the unit and this manual. If there are any questions please refer to your supplier.

2.1 Connection to a 75-ohm un-balanced G.703 / E1 network

For use on a 75-ohm un-balanced service connection should be made using the two B.N.C. connectors on the front panel of the FourthRack G.704 Line Card. These are labelled as "Rx" and "Tx". Your G.703 carrier service equipment may be labelled with transmit and receive. The FourthRack G.704 LC "RX" port should be connected to the receive side of the carrier equipment. The FourthRack G.704 "TX" port transmits carrier and this should be connected to the out-bound port of the carrier service.

2.2 G.703 75-ohm Cable Schedule

Connections should be made using 75-ohm co-axial cables with B.N.C. connectors. The co-ax cables required are two off, 75-ohm co-ax cables, of 5mm diameter, which must be terminated, in male BNC connectors. The maximum cable attenuation must be 6db at 1024kHz. The attenuation characteristics should follow the "root f" law. Cable type RG59, or 2002, or equivalent, should meet this specification.

2.3 Connection to a 120-ohm balanced G.703 / E1 network

For use on a 120-ohm balanced service connection should be made using the RJ45 connector on the front panel of the 120-ohm version of the FourthRack G.704 LC. This is labelled as RJ45. The pin out for the RJ-45 is as defined for ONP/CTR-12 and is given in the specification section.

2.4 Status Indicators

There are five LED status indicators on the front panel of the FourthRack G.704 Line Card. Reading from the top of the front panel these are labelled P, N, C, T and L.

The green 'P' LED indicates that the FourthRack G.704 LC is receiving power from the FourthRack back plane. The FourthRack Chassis and the FourthRack G.704 support 'hot-swap'. The FourthRack G.704 has a built-in power-up control system. The 'P' LED will illuminate a few seconds after the FourthRack G.704 Line Card is inserted into the rack and the back plane connection has been made.

The green 'N' LED indicates that the FourthRack G.704 Line Card is receiving correctly encoded data from the line interface equipment.

The amber 'C' LED indicates that the FourthRack G.704 Line Card is set to clock master mode. See set-up section for setting the clock master mode.

The amber 'T' LED will illuminate when the use of the Terminal Timing option is selected. See set-up section for setting the terminal timing mode.

The amber 'L' LED will illuminate when the loop-back condition is selected. (See below for Loop Back operation)

2.5 Loop back Control

Loop Back can be selected by pressing the small recessed push button switch between the T and the L indicators labelled LB. Loop back mode is cancelled by pressing the LB switch again. If the Loop Back mode is not deselected using the switch the Line Card will automatically revert to its normal operating mode after 2 minutes.

3 Installation

3.1 Connecting to DTE

Connection to the DTE is made using the 15 way "D" socket. Versions of the FourthRack G.704 Line Card are available that support X21 or X21 and V35. The pinout is given in the specification section

3.2 Clock master / clock slave settings

When using a FourthRack G.704 Line Card system in conjunction with a MicroMux G.703/4, or when using a FourthRack G.704 LC at either end of a 2048kbit/s circuit in clear channel operation, one of the units should be set to clock master. The Fourthtrack Systems recommendation is to set the system that is closest to the network core to clock master and the unit that is closest to the subscriber / customer site to clock slave.

3.3 Data polarity and clock polarity settings

The data transmitted and received on the G.703 side of the FourthRack G.704 could have originated on another piece of equipment. It is not uncommon for the data to be inverted by G.703 terminating equipment. The FourthRack G.704 has the option to invert or not invert the data transmitted and received on the G.703 port. See the set-up section for the default setting and changing the data polarity.

In some cases, when using an X.21 interface, the data received from the DTE may be mis-aligned with the X.21 timing signal, and this can cause errors. This situation can usually be overcome by changing the polarity of the clock used to clock in the received data, with respect to the X.21 timing signal. The FourthRack G.704 has the option to change the polarity of the clock used to clock in received data. See the set-up section for the default setting and changing the clock polarity.

4 Set-up

4.1 Jumper functions and default settings

The start-up configuration of the FourthRack G.704 Line Card is controlled by jumpers grouped in link fields. The primary link field is identified as LK11. It is located toward the rear of the Line Card adjacent to the back plane connector.

In a managed system the start-up configuration of the FourthRack G.704 Line Card is read from NV-RAM or up-loaded from the FourthRack Management Card, as defined by the management settings.

Configuration Jumper Table

| Ident | Open | Closed |
|-------------------|---|--|
| 21-22 (by R18) | Read/Write - Managed use only | Read Only - for Managed & Unmanaged use (default) |
| 19-20 (by R51) | TS0 Disabled (default) | TS0 Enabled |
| 17-18 (by R50) | LIU CRC4 Disabled (default) | LIU CRC4 Enabled |
| 15-16 (by R48) | DTE RXD Clock Inverted (default) | DTE RXD Clock Not Inverted |
| 13-14 (by R47) | DTE RXD clocked from recovered G.703 timing (default) | DTE RXD clocked from DTE TTC. (see note(1) on timing skew below) |
| 11-12 (by R46) | AIS disable | AIS enable (default) |
| 9-10 (by R45) | G.703 Data Inverted (default- see note (2) below) | G.703 Data Not Inverted |
| 7-8 (by R44) | See below: "4.2 Data Rate / Timeslot allocation". (Default is 2048 Kbps - clear channel) | |
| 5-6 (by R43) | | |
| 3-4 (by R42) | | |
| 1-2 (by R41) | G.703 Clock Slave (default) | G.703 Clock Master (see MTTC for source) |

Note (1) - used to cancel skew in loop timing due to buffers and cable propagation delays. Recovered G.703 clock is presented on DTE CLK to be looped back at the far end on DTE TTC.

Note (2) - the normal or default operation is with the data inverted. (NB Fitting the link inverts the data from this 'normal' state. This is consistent with the 'DINV ON' state displayed by the managed unit user interface and the switch being in the 'ON' position for standalone units.)

4.2 Data rate / timeslot allocation

Links 3-4, 5-6 and 7-8 are used to set the data rates manually. Please refer to the table below.

| Data rate | Timeslot allocation | 3-4 | 5-6 | 7-8 |
|--------------------------------|---------------------|--------|--------|--------|
| 1984 ⁽¹⁾ Kbps | 1 → 31 | Open | Open | Open |
| 1920 ⁽¹⁾ Kbps | 1 → 15 & 17 → 31 | Closed | Open | Open |
| 1024 ⁽²⁾ Kbps | 1 → 16 | Open | Closed | Open |
| 1024 ⁽²⁾ Kbps | 1 → 15 & 17 | Closed | Closed | Open |
| 512 ⁽²⁾ Kbps | 1 → 8 | Open | Open | Closed |
| 256 ⁽²⁾ Kbps | 1 → 4 | Closed | Open | Closed |
| 128 ⁽²⁾ Kbps | 1 → 2 | Open | Closed | Closed |
| 2048 ^(2&3) Kbps | 0 → 31 | Closed | Closed | Closed |

- Note (1) Gapped clocking is used to accommodate this data rate. Clock speed is 2048 Kbps.
- Note (2) Continuous clock
- Note (3) Clear channel (unstructured G.703) operation

4.3 Management capability

The FourthRack is available with management. The management is supported by using a different power supply module that includes the management function. The FourthRack may be used with either one or two of the management enhanced power supplies providing resilience for both power and the management function.

Configuration parameters selected using LK11 may be overridden via FourthRack management. Management selected configuration options are maintained in non-volatile memory when the card is removed or when power is lost. If set to 'read only' the FourthRack G.704 will power-up with the configuration defined by its LK4 settings. If set to 'read / write' the FourthRack G.703 will power-up with the configuration defined by management and saved in its non-volatile memory.

For full details on the management functionality refer to the User Guide supplied with the rack.

4.4 Interface selection on dual function X.21 / V.35 version

The enhanced version of the FourthRack G.704 Line Card can support both X.21 and V.35 DTE. The DTE interface function is selected using a link field identified as 'V X'. It is located toward the front of the Line Card adjacent to the DTE connector. Links in the 'V X' link field are three position. One or other option must be selected for the DTE interface to function. DTE interface status is readable by management, however, as the links in this field control signal termination and drivers they cannot be overridden by management.

| Ident | V.35 | X.21 |
|-------|------|------|
| LK8 | V | X |
| LK13 | V | X |
| LK14 | V | X |

| Ident | V.35 | X.21 |
|-------|------|------|
| LK15 | V | X |
| LK16 | V | X |
| | | |

5 Specifications

5.1 On Board Master Clock

Operating Frequency: 2.048 MHz ± 50 PPM @ 25 deg. C

5.2 Network Interface Signals Specification

The Network Interface conforms to CCITT specification G.703 and ETSI Open Network Provision for digital unstructured leased line (D2048U).

Transmit.

| | |
|------------------------|--|
| Output Pulse amplitude | 2.37 V into 75R + 10% 3.00 V into 120R + 10 % Min 8 dB - Max 14 dB |
| Return Loss | |

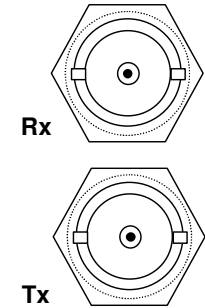
Receive.

| | |
|--|-----------|
| Sensitivity Below (0dB = 2.4 V) | - 10dB |
| Loss of Signal Threshold | 0.3V |
| Return Loss | 18 dB |
| Allowable consecutive Zeros before LOS | 190 bits. |

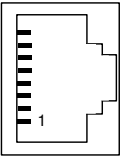
5.3 Network Connectors

Two versions of the FourthRack G.704 Line Cards are available

75 Ohm Unbalanced



120 Ohm Balanced



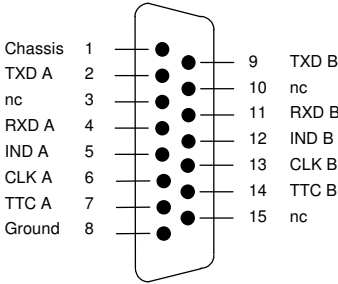
G.703

| RJ45 Pin | Function |
|----------|--------------------------|
| 1 & 2 | Rx pair from network |
| 3 | Shield reference point |
| 4 & 5 | Transmit pair to network |

5.4 Shield reference point

Note that the Receive Shield reference point is taken to ground via a link field. Fitting the jumper LK17 connects Receive Shield to ground.

5.5 DTE Connector



15 way D type Socket

5.6 Environmental

The FourthRack G.704 Line Card is designed to operate under the following conditions.

| | |
|-----------------------|------------------------------------|
| Ambient temperature: | 5 to 45 degrees Celsius. |
| Relative humidity: | 10 to 90 percent (non-condensing). |
| Atmospheric pressure: | 86kPa to 106kPa. |
| Power requirement: | Powered via the FourthRack chassis |